Current ExMC projects

Project	Overview	Current NASA Planned Activities/Deliverables
Wireless Sensors and Data Systems	The crewmembers' physiological data, if monitored regularly, can indicate to the flight surgeons if there is a medical problem. During EVAs and periodic IVA activities, the flight surgeons need the ability to monitor key physiological signals that indicate the crew's work load and other physiologic parameters. The current system for donning the sensors is time consuming and inconvenient, requiring shaving, application of electrodes, and signal checks. A more efficient system will save crew time and reduce the overhead of stowing additional supplies. This system will be achieved through the integration of small, easy to use biomedical sensors that will have the ability to measure, store and transmit physiologic parameters (ECG, SPO2, heart rate, BP, ETCO2, temp, etc) during operational and ambulatory scenarios. Such a system would also provide a wealth of data for the medical and research communities. Coordination with the HHC element will for an overall medical and research biomedical sensing plan will occur.	• Continue to assess and evaluate high/emerging TRL and COTS minimal contact sensors and systems for EVA and IVA applications • Procure, test and evaluate relevant sensor technologies in a variety of laboratory, benchtop and analog environments. • Refine the design for a biomedical monitoring system architecture build and demonstrate a proof of concept prototype. • Continue to development the EVA suit universal data hub communications system
Oxygen Generation Systems	Currently on the ISS, the crewmember's source of additional oxygen if needed is the onboard oxygen tanks. The system provides 100% oxygen to the crewmember, the expired oxygen can exceed the spacecraft oxygen limit within hours. For the smaller Constellation vehicles, close interface with spacecraft designers and fire safety experts will be required to ensure safety margins are met. A system which concentrates the oxygen within the cabin environment and provides the required concentration of oxygen to the crewmember based on their oxygen saturation level will be necessary to meet these requirements.	• Technology watch of oxygen concentrators and portable oxygen concentration systems. • Development of smart devices with closed –looped ventilation algorithms. (See Lightweight Trauma Module)
Lightweight Trauma Module	Onboard advanced medical life support hardware will be required to treat the crewmembers on a regular and emergency basis. Technologies which are smarter, smaller, lighter, reliable, and user-friendly will be required to fit within the limited space of the spacecraft vehicles. These devices will not only monitor the patient but also be able to provide some treatment such as ventilation and fluid resuscitation with closed-looped algorithms. In addition, smart help will be provided to the care givers in a just-in-time fashion.	• ISS model ready for flight in FY2013 • Lunar surface model, TRL6 ready in FY2015
Medical Grade Water	Currently, limited quantities of IV fluid are launched, stowed, and disposed of	• Prototype model for ISS test

Generation	or returned to Earth (due to limited life) on the International Space Station. These IV fluids take up valuable launch mass/volume, stowage volume onboard the ISS, and waste disposal volume. The ability to generate Water for Injection on-demand will minimize these resource impacts. The Water for Injection will be mixed with the necessary medications on the lunar surface for immediate use.	• FDA approval
Inflight Laboratory Analysis	Analyzing bodily fluids (urine, blood, saliva) on the lunar surface will reduce launch/return mass/volume and provide the data near real-time in lieu of postflight results. A system to perform this analysis "inflight" is necessary to meet these requirements. NASA has conducted several trade studies analyzing hardware available and developed an Excel-based tool to quantify the ability of hardware to meet mission requirements. To reduce system mass and volume, beginning with the FY 2007 SBIR call and the FY2008 budget year, NASA will begin developing concepts and hardware for reusable systems of this type. Such miniaturized systems are dependent upon space medical standards and requirements that will be determined based on expert opinion, risk assessments and evidence bases. These standards and requirements are critical for engineering and medically qualifying the appropriate system for remote space applications. The results of the recent Sample Return Analysis task may be considered in the near-term for potential ExMC leveraging opportunities. Since no medical diagnostic device that involves blood or urine fluid analysis is currently operational, it will be important to establish that such a device may be operated routinely. In addition to microfluidic processing systems, non-invasive monitoring devices may also be considered.	• Extract the ExMC relevant information and technologies from the ISRA study and summarize with respect to ExMC objectives. • Provide a draft summary of technologies for minimally or non-invasively removing human biological sample for diagnostics. • Develop an In-flight laboratory analysis prototype plan. • Develop an In-flight laboratory analysis prototype.
Assisted Procedures Techniques	Due to the limited medical skills and training of the crew, techniques to help the crewmembers perform medical procedures will be required. This will reduce the time required to perform the procedure, allow the crew to refresh their training skills during the mission, and provide the crew with audio and visual information to guide them through the procedure efficiently. This has the possibility to develop into a decision support system.	• Guideview on a PDA platform that provides a smarter "medical checklist" • Voice recognition technology integration
Integrated Medical Model	Due to limited resource volume constraints of the mission designs (including volume, mass, power, crew time, and crew skills), only the most critical	• Validated model and Exploration Medical Capability Requirements

	medical equipment will be stored onboard the space vehicles to treat illnesses or injuries in the event of an emergency. In addition, crew training time pre-flight is limited to those medical procedures most likely to occur. Because the astronauts are not likely to be trained medical clinicians, their skill level must be considered in the treatment of medical procedures. The likelihood and outcome of critical patient conditions occurring along with the required resources (including those listed above) to treat the conditions must be analyzed to determine the level of risk to the astronauts in a quantitative manner. This allows management tradeoffs between resources and acceptable risk levels for various mission scenarios. The Integrated Medical Model (IMM) is intended to be a Probabilistic Risk Assessment (PRA) simulation to provide this quantitative risk assessment.	
Mission Medical Information System	Incorporate medically relevant information into a database system for use in operations as well as for research support. The data sources to be incorporated include data from all pre in and postflight clinical tests (MRID's) as well as other mission data. Currently the data resides on an FTP server, in flight surgeon files, some in the EMR, and some in the LSAH database. Structured data sources such as the EMR and LSAH will not be duplicated, but rather joined. Effort refocused to get data into structured form first and then work on data entry at the point of collection. Effort is co-funded 50/50 with Crew Health and Safety.	• Structured Information System fully populated with NASA medical space flight data and information.
Life Science Data Archive	NASA's Life Sciences Data Archive (LSDA) is a work in progress that provides information and data from space flight experiments funded by the National Aeronautics and Space Administration (NASA). The archive includes investigations from 1961 (Mercury Project) through current missions (International Space Station and Shuttle) involving human, plant and animal studies. Efforts include a process to streamline access while protecting confidentiality.	• Archive flight and relevant ground experiments
Advanced Medical Fluids	Research and development of technologies for integration into the EVA suit architecture to manage fluids in a contingency requiring extended stays in the suit.	• High calorie, low residue nutrition • Improved Maximum Absorbency Garment for waste management • Vacuum-rated injectable medications